

Internationally, there has been much sharing of data involving stem cell research. Many nations have banned or limited research in this area due to local, cultural and religious traditions.

Where do you stand in the debate about the nature of stem cell research? How do you feel about the source of pluripotent stem cells?

replace differentiated cells lost due to injury and disease. This involves therapeutic cloning. Parkinson's disease and Alzheimer's disease are caused by loss of brain cells, and it is hoped that implanted stem cells could replace many of these lost brain cells thus relieving the disease symptoms. Certain forms of diabetes deplete the pancreas of essential cells and it is hoped that a stem cell implant in this organ could have positive effects. As most of the research at present is occurring in mice, it is likely to be quite a time before this treatment approach becomes possible in humans.

However, there is a type of stem cell treatment that has been proceeding successfully in humans for many years. Besides embryonic or pluripotent stem cells, there are tissue-specific stem cells. These stem cells reside in certain tissue types and can only produce new cells of that particular tissue. For example, blood stem cells have been routinely introduced into humans to replace the damaged bone marrow of some leukaemia patients.

There are important ethical issues involved in stem cell research. Especially controversial is the use of embryonic or pluripotent stem cells. This is because these cells come from embryos often obtained from laboratories carrying out in-vitro fertilization (IVF). To gather these cells involves death of the embryo and opponents argue that this represents the taking of a human life. On the other hand, it is argued that this research could result in the significant reduction of human suffering and is, therefore, totally acceptable.



How the scientific community conveys information concerning its research to wider society is very important. This information must be accurate, complete and understandable so that society can make informed decisions as to the appropriateness of the research. For example, in 2005, stem cells successfully helped to restore the lost insulation of nerve cells in rats thus resulting in greater mobility of the animals.

But there is a need to balance the very great opportunities of this type of research with the potential risks. For example, there is recent evidence that some types of cancer may be caused by stem cells undergoing a malignant transformation. This shows possible risk in the implantation of stem cells.

### Exercises

- 1 How would the excretion of metabolic wastes from cells be related to the concept of surface area to volume ratio?
- 2 Name two disadvantages of using an electron microscope.
- 3 How does specialization in muscle and nerve cells affect their ability to reproduce?
- 4 What would prevent stem cells from other species being successful in humans?

## 2.2 Prokaryotic cells

### Assessment statements

- 2.2.1 Draw and label a diagram of the ultrastructure of *Escherichia coli* (*E. coli*) as an example of a prokaryote.
- 2.2.2 Annotate the diagram with the functions of each named structure.
- 2.2.3 Identify structures from 2.2.1 in electron micrographs of *E. coli*.
- 2.2.4 State that prokaryotic cells divide by binary fission.